Pediatric Urology

Prenatal Hydronephrosis—Are Voiding Cystourethrograms Necessary?

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Three important papers providing insights on the management of ureterovesical junction reflux are reviewed. During the past decade, there has been widespread use of screening prenatal ultrasonography. Prenatal hydronephrosis may be a manifestation of reflux. Herndon and colleagues review a multicenter experience concerning outcomes in neonates with reflux that was diagnosed prenatally. Yerkes and associates look at the question of whether all neonates with prenatal hydronephrosis and low grades of dilation require a voiding cystourethrogram (VCUG). Vates and colleagues review the safety and complication rates of VCUG in the neonate. Finally, Upadhyay and associates study the long-term outcome of surgical treatment for infants with high-grade reflux requiring reimplantation during the first year of life.

A Multicenter Outcomes Analysis of Patients With Neonatal Reflux Presenting With Prenatal Hydronephrosis

Herndon CDA, McKenna PH, Kolon TF, et al.
J Urol. 1999;162:1203-1208.

Between 10% and 30% of prenatal hydronephrosis may be due to reflux. This multicenter series systematically details the prenatal findings and postnatal outcomes in 71 infants (56 boys, 15 girls). Hydronephrosis was observed in 112 of 116 refluxing renal units and was detected at the end of the second trimester. The hydronephrosis was mild in 88% (renal pelvic diameter less than 10 mm), moderate in 9% (10 to 20 mm), and severe in 3% (greater than 20 mm). Although one might expect increased dilation of the collecting system during in utero voiding, this phenomenon was observed in only 4 renal units. All 26 of the ureters visualized were associated with high-grade reflux. Since there were no findings other than hydronephrosis in these prenatal sonograms, it is understandable that the obstetrician entertained the diagnosis of reflux in only 25% of the patients. The diagnosis often remained elusive until VCUG was performed, since 25% of the neonates had normal postnatal ultrasonograms.

In only one third of cases did unilateral hydronephrosis represent unilateral ipsilateral reflux. In other cases, reflux also occurred in the nonhydronephrotic, contralateral renal unit. Bilateral hydronephrosis was associated with bilateral reflux in 87%. About 50% had low grades of reflux (grades 1 and 2), which resolved within 2 years in both boys and girls. In infants with high-grade reflux, 20% of this reflux in the boys resolved in just under 1 year, while about 35% of the reflux in the girls resolved by about 2 years. Not only did bilateral reflux resolve spontaneously, but reflux in 11 high-grade refluxing units also resolved. These phenomena occurred twice as frequently in boys as in girls. Seventeen infants, 16 of whom were male, underwent ureteral reimplantation. Surgery was performed at about 14 months of age. The indications for surgery were urinary tract infection (UTI) in 80% and a deterioration of renal function, determined by renal scanning, in 18%. Half of the uncircumcised male infants had a UTI, whereas a UTI developed in only 20% of circumcised infants while they were on prophylactic antibiotics.

This study provides important observations for interpretation of prenatal sonograms. The authors have identified parameters that predict reflux on the prenatal sonogram in male infants, which include hydronephrosis that increases with voiding, visualization of a ureter, and a family history of reflux.

The multicenter study also provides important information for prenatal counseling of parents whose fetus has been noted to have hydronephrosis. It emphasizes that

high-grade reflux, especially in male patients, will commonly resolve at a rapid rate. We have proposed that early fetal transient functional obstruction is a possible cause of this high-grade reflux in male patients.[1] This may be due to bladder dysfunction associated with dyssynergia of the external urinary sphincter (EUS). To gain insights into the etiology of high-grade reflux, Shapiro and colleagues at New York University investigated the development of bladder smooth muscle and external urinary sphincter skeletal muscle and the innervation to these structures in male fetuses. These investigators show that in the fetus, the bladder and EUS transiently express a mixed phenotype of both smooth and skeletal muscle during early development. The coexpression of smooth and skeletal muscle markers in these structures precedes the conversion of smooth muscle in the bladder and skeletal muscle in the EUS. The bladder also develops its neural innervation several weeks before the EUS. Delayed or altered muscular differentiation and innervation of the bladder and EUS may affect the function of these structures adversely and contribute to the development of gross bilateral reflux. These observations are supported by the findings of Sillén et al.[2] They observed low bladder capacity and hypercontractility during early infancy that may be a result of this transient functional obstruction and contribute to the development of reflux.

References
1. Shapiro E, Perlman EJ, Kalousek DK. Early development and innervation of the human fetal bladder and external urinary sphincter musculature: insights into bilateral gross reflux [abstract]. *J Urol.* 1998;159(suppl):77.
2. Sillén U, Hjälmås K, Aili M, et al. Pronounced detrusor hypercontractility in infants with gross bilateral reflux. *J Urol.* 1992;148:598-599.

Does Every Patient With Prenatal Hydronephrosis Need Voiding Cystourethrography?

Yerkes EB, Adams MC, Pope JC, et al.
J Urol. 1999;162:1218-1220.

Yerkes et al posed the question of whether all patients with prenatally diagnosed hydronephrosis require VCUG postnatally. They examined a specific subset of patients with hydronephrosis who had less than grade 2 hydronephrosis (based on the Society of Fetal Urology grading system). These patients have a very mild degree of pyelocalyceal dilatation. The investigators identified 56 of 175 children who had less than grade 2 unilateral or bilateral hydronephrosis. Forty patients underwent VCUG, and 16 patients were observed. Of 40 patients with low-grade hydronephrosis, 6 (15%) were found to have reflux. This is significantly more than the 1% of the general pediatric population who are found to have reflux. Three of these 6 patients had grade 3 to 5 hydronephrosis; 1 with high-grade reflux required reimplantation. In the 16 patients who did not undergo VCUG, the hydronephrosis stabilized or resolved. These patients received prophylactic antibiotics for 6 to 8 months, and ultrasonographic studies and urinalyses were performed every 3 to 6 months for 1 year. These authors conclude that VCUG is not mandatory for patients with low-grade hydronephrosis.

This study is somewhat controversial in that it examines a subset of patients with prenatal hydronephrosis for whom the authors do not feel VCUG is indicated. Concern about morbidity is the reason for not obtaining VCUG. Although there is a 6% morbidity rate reported in the literature, the study by Vates et al (below) should allay these concerns, assuming that the patient has been given prophylactic antibiotics before VCUG.

If 15% of infants with very-low-grade hydronephrosis have reflux, then two patients in the reported series did not have their reflux diagnosed. These two patients may eventually present with pyelonephritis. One of the benefits of prenatal diagnosis of hydronephrosis has been the significant decrease in the number of infants and children presenting with urosepsis and pyelonephritis. In 2000, all families of children with prenatally diagnosed hydronephrosis should be offered a VCUG with the long-term goal of avoiding pyelonephritis in the future. It would be disconcerting to have to treat a patient for urosepsis when it can be avoided with a safe radiographic examination and appropriate antibiotic prophylaxis until reflux resolves.

Complications of Voiding Cystourethrography in the Evaluation of Infants With Prenatally Detected Hydronephrosis

Vates TS, Shull MJ, Underberg-Davis SJ, et al.
J Urol. 1999;162:1221-1223.

Vates et al retrospectively reviewed the complications associated with VCUG in patients with a prenatal diagnosis of hydronephrosis. They assessed the incidences of lower UTI, pyelonephritis, urosepsis, gross hematuria, urinary retention, and rash following the procedure. Of 206 patients with hydronephrosis, 178 underwent VCUG. This study showed no reflux in 138 patients (80%), while 36 (20%) of 178 received a diagnosis of reflux. One ureterocele was observed. Of the 129 male patients, 101 were circumcised. Prophylactic antibiotics were given to 166 patients undergoing VCUG. UTI, pyelonephritis, or urosepsis did not develop in any patients. There were no episodes of urinary retention, gross hematuria, or rash. This retrospective review reiterates the safety of performing VCUGs for neonates with a prenatal diagnosis of hydronephrosis. This complication rate is much lower than the 6% reported in the literature.

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Ureteral Reimplantation in Infancy: Evaluation of Long-Term Voiding Function

Upadhyay J, Shekarriz B, Fleming P, et al.
J Urol. 1999;162:1209-1212.

These authors report the experience at the Children's Hospital of Michigan between 1984 and 1993 of ureteral reimplantation in 21 children aged less than 1 year. During follow-up of 5 to 13 years (mean, 9.5 years), the investigators acquired their data through questionnaires, including the patient's age at toilet training, continence, enuresis, dysuria, urinary urgency, frequency of urination, abdominal or suprapubic pain, history of UTI, and prophylactic antibiotic use. Uroflowmetry and an estimation of patients' postvoid residual urine were also obtained.

The patients underwent ureteral reimplantation primarily for reflux, although one third had ureterovesical junction obstruction. Numerous reimplantation techniques were used. Eight patients required excisional or folding techniques. Extravesical, Cohen, and modified Politano-Leadbetter techniques were used in others. The surgical complication and morbidity rates were low. Only 1 patient (4.7%) required another ureteral reimplantation for symptomatic high-grade reflux 3 years postoperatively. One patient had persistent low-grade unilateral reflux. The other 19 patients all showed resolution or absence of reflux postoperatively. There was no postoperative ureteral obstruction.

This group of patients was followed to determine whether early reimplantation affected voiding function. The authors found that infrequent voiding was twice as common in girls as in boys (57% vs 29%). There was no obvious cause-and-effect relationship between early surgery and subsequent voiding frequency, nor was voiding frequency related to the type of reimplantation performed. One patient had an occasional episode of UTI, yet her radiographic studies remained satisfactory and without evidence of reflux, and she had a normal voiding pattern. All patients except one had an insignificant postvoid residual and a significantly increased bladder capacity for their age. These data show that the long-term success rate in neonatal ureteral reimplantation is greater than 90%, even when the ureter requires excision or tapering. Also, most of these children develop normal continence and voiding patterns.

The review from Children's Hospital of Michigan is novel and asks the question of whether early surgery in infants with high-grade reflux affects long-term voiding function. These surgeons demonstrate that ureteral reimplantation, with or without tapering, can be performed safely and successfully in most infants. Voiding function in almost all patients studied was normal. The rate of infrequent voiding, which was found to be higher in girls than in boys, is most likely a function of habit and not due to the surgery. The surgical results of these authors are consistent with those reported previously in the literature. Only one patient developed a bladder capacity that was twice the normal-for-age capacity, but again, this was likely unrelated to the surgical technique. ■

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Perirenal fat was replaced over the cryosurgical site, and the peritoneum was closed. Drains were left in place postoperatively.

There were no intraoperative or postoperative complications in any patients. Mean operative time was 210 minutes, with minimal blood loss occurring. Mean hospital stay was 3.5 days. Biopsies revealed renal cell carcinoma in six patients and were indeterminate in two patients. At a mean clinical follow-up of 7.7 months (range, 1 to 18) and a radiographic follow-up of 5 months, there had been no tumor recurrences.

The combination of cryoablation and a minimally invasive approach such as laparoscopy is an interesting area of study. Larger series with long-term follow-up will ultimately determine the utility of this combination in the management of small renal tumors. Observation of the borders of the ice ball with intraoperative ultrasonography may minimize the possibility of positive margins. The authors conclude that cryosurgery may be an effective treatment for well-selected patients. ■